

Applicant: Knight

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IN THE DRAWINGS:

A new sheet with new Figure 4 has been added to show a second one of the rocker arms.

Remarks

No new matter has been added by this amendment. The present application was filed on November 4, 2003 with original claims 1-15. In response to a Restriction Requirement, Applicants elected claims 1-8, 10, 12, 13, and 15. Thus, claims 9, 11, and 14 are withdrawn. By this amendment, claims 1, 3, 5-8 and 12-13, 15 are amended and claims 2, 4, 10, and 13 are cancelled. The claims remaining in consideration are claims 1, 3, 5-8, 12-13, and 15. Reconsideration is respectfully requested.

The Examiner objected to the drawings under 37 CFR 1.83(a). Specifically, the Examiner objected to the drawings for failing to show the first, second and third rocker members of claim 5 (the first and third rocker members being shown in Figure 1). A new Figure 4 has been added to clearly show the second rocker member 31.

Secondly, the Examiner objected to the drawings for failing to show that longitudinal axis of the rocker shaft is arranged to “extend substantially perpendicular to a longitudinal axis of the pumping plunger” as required by claim 6. Claim 6 and the specification (specifically, paragraph [0028]) has been amended to more accurately reflect the invention as shown in the drawings. Namely, that the rocker member shaft has a longitudinal axis having “a plane extending in a direction substantially perpendicular to a plane of the longitudinal axis of the plunger 20.”

The Examiner objected to the Specification for reasons similar to those addressed in the preceding paragraph. Applicants have amended paragraph [0028] to address the Examiner’s objections.

Claims 1, 3, 6-8, 12, and 15 were rejected under 35 USC §102(b) as being unpatentable over EP0704619 (“Bauerle”). This rejection is respectfully traversed.

Claim 4 was rejected under 35 USC §103(a) as being obvious over Bauerle. Claims 4 and 5

were rejected under 35 USC §103(a) over Bauerle in view of US Patent 6,026,786 issued to Groff et al ("Groff"). The §103(a) rejections are respectfully traversed.

It should be noted that the §102(b) rejection of claims 6-8 is improper, since claims 6-8 are dependent on claim 4, which was rejected under 35 USC §103(a).

Claims 1, 12 and 15 are independent claims. Independent claim 1 has been amended to incorporate the limitations of now cancelled claims 2 and 4. Corresponding amendments have been made to independent claims 12 and 15.

Bauerle discloses a common rail fuel system in which the common rail is integrated within the rocker shaft. As is typical with common rail systems, the common rail is arranged to supply fuel to a number of electromagnetically operated injectors. However, Bauerle does not describe a fuel system comprising an accumulator volume integrated into the rocker shaft, the accumulator volume being arranged to supply fuel to a plurality of injectors at a first pressure level, each of the injectors being associated with an additional pumping element for pressurizing fuel supplied to the injectors from the accumulator volume to a second pressure level that is higher than the first pressure level.

Thus, applicants respectfully assert that independent claims are patentable over Bauerle and request that the rejections be withdrawn.

Groff discloses a unit injector system, a pumping plunger which is operated by a cam driven rocker arm. The Examiner argues that the systems of Groff and Bauerle are functionally equivalent and interchangeable.

It is true that the Groff system and the Bauerle systems may be used to inject fuel into injectors. However, they are functionally different and separate types of systems. Bauerle uses a common rail scheme, as does the present invention. Groff, on the other hand utilizes a unit pump injector scheme.

As of the date of the invention, fuel injection technology can be split into two types of injection schemes. First, there are common rail systems, which use a common source of pressurized fuel to supply (typically) four, six or eight injectors. Usually electromagnetic injectors are used in common rail systems, the injectors operated to deliver fuel at a single common rail pressure into the combustion cylinders of the engine. Although common rail systems are flexible in terms of fuel injection timing, the injection pressure is limited by the structural limitations of the common rail to withstand the pressures of fuel contained within. Therefore, it is usual for common rail systems to be used in relatively light duty applications, for example, cars and light delivery vehicles, which usually require lower injection pressures. As of the priority date of the invention, the prevailing focus of common rail system development was towards devising means to increase maximum pressure that the common rail can withstand, in order to increase fuel economy for example.

The unit pump injection scheme makes use of a fuel injector that is associated with a pumping element. In these types of systems, fuel at relatively low pressure, i.e. from a fuel tank, is supplied to the injector by a transfer pump. Fuel is then pressurized to high pressure level by the pumping plunger and the injector is then controlled to inject high-pressure fuel into the cylinder. Although very high injection pressures are achievable by way of this type of arrangement, fuel injection timing is restricted since the timing is dependent on rotation of the cam that drives the pumping element. Improvement is the other typically focused on improving injection flexibility.

The present invention includes an accumulator volume, formed in a rocker shaft of an engine, whereby the accumulator volume is arranged to supply fuel to a plurality of injectors at a first pressure level and a pumping element is arranged to pressurize fuel to a second pressure level that is higher than the first pressure level. The injectors of the present invention are therefore operable to inject fuel into their respective cylinders at a first pressure level, for example, during periods of

relatively low engine power demand, or at a second, higher pressure level, for example during periods of high engine power demand. The invention therefore achieves improved flexibility of injection in addition to achieving high injection pressures. Furthermore, the incorporation of the accumulator volume in the rocker shaft enables a reduction in the size of the engine layout as well as a weight and cost saving by avoiding the requirement for a separate common rail and rocker shaft.

For the reasons set forth above, applicants respectfully assert that neither Bauerle nor Groff teach or suggest the features of independent claims 1, 12 and 15 and furthermore, that there is no motivation to combine the features of the unit pump injector scheme of Groff system with the separate and distinct common rail system disclose in Bauerle. Therefore, applicants respectfully request that the §102(b) and §103(a) rejections be withdrawn.

All of the Examiner's objections and rejection having been successfully made moot or traversed, applicants respectfully assert that the present application is now in condition for allowance. An early Notice of Allowance is solicited.

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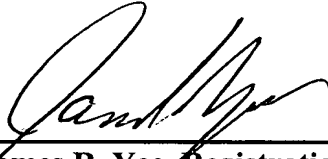
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Applicants believe that no fees are due, however, if any become required, the Commissioner is hereby authorized to charge any additional fees or credit any overpayments to Deposit Account 08-2789 in the name of Howard & Howard Attorneys, P.C. Further and favorable reconsideration of the outstanding Office Action is hereby requested.

Respectfully submitted

HOWARD & HOWARD ATTORNEYS, P.C.



June 15, 2005

Date

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CERTIFICATE OF MAILING

I hereby certify that this **Amendment** for Serial Number 10/701,142 is being deposited with the United States Postal Service as First Class Mail, postage prepaid, in an envelope addressed to the Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450 on **June 15, 2005**.



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